CLAIMS

1. A method of imaging large volumes without resulting slab-boundary artifacts comprising:

defining a desired FOV larger than an optimal imaging volume of an MR scanner;

selecting a slab thickness in a first direction that is smaller than the desired FOV and within the optimal imaging volume of the MR scanner; and

continuously moving one of the optimal imaging volume and an imaging object in the first direction while repeatedly exciting and encoding spins with readout in the first direction to acquire data that is restricted to the selected slab thickness until at least one image of the FOV can be reconstructed.

2. The method of claim 1 further comprising the step of using another set of MR data to track motion of one of the optimal imaging volume and an imaging object.

3. The method of claim 1 further comprising reconstructing the acquired data to form at least one of a 2D image and a 3D image.

4. The method of claim 1 further comprising the step of using a portion of the acquired MR data to track motion of one of the optimal imaging volume and an imaging object.

5. The method of claim 1 wherein the step of exciting and encoding spins is further defined as restricting data acquisition by encoding and filtering data so as to acquire data that is limited to the selected slab thickness.

6. The method of claim 1 wherein the step of exciting and encoding spins is further defined as restricting excitation in at least one direction other than the first direction.

7. The method of claim 1 wherein the first direction is defined as a z-direction.

8. The method of claim 1 wherein each MR data acquisition during continuous movement includes acquiring all k-space data in a direction of motion of a patient table for a selected subset of transverse k-space data.

9. The method of claim 1 further comprising reducing exam time by imaging during table motion.

10. The method of claim 1 further comprising processing the set of MR data using a gridding reconstruction.

11. The method of claim 1 further comprising the step of maintaining a position of slab thickness fixed relative to a magnet of the MR scanner during imaging of the desired FOV and the continuous moving of one of the optimal imaging volume and the imaging object.

12. The method of claim 1 further comprising applying gradient waveforms on an axis parallel to the first direction while acquiring imaging data.

13. The method of claim 1 further comprising:

processing MR data to account for accrued phase resulting from table velocity;

transforming MR data in a z-direction;

correcting the MR data for spatial variations in the magnetic field in the direction of motion;

removing unnecessary data at the beginning and ending of each acquisition; and

sorting, interpolating, and aligning the transformed MR data to match anatomic locations in the first direction.

14. The method of claim 13 further comprising reconstructing an MR image by transforming the z-transformed MR data in remaining transverse dimension(s).

15. The method of claim 13 further comprising gridding the z-transformed MR data in dimension(s) perpendicular to the first direction to reconstruct an MR image.

16. An MRI apparatus to acquire multiple sets of MR data with a moving table and reconstruct MR images without slab-boundary artifacts comprising:

a magnetic resonance imaging (MRI) system having a plurality of gradient coils positioned about a bore of a magnet to impress a polarizing magnetic field, and an RF transceiver system and an RF switch controlled by a pulse module to transmit RF signals to an RF coil assembly to acquire MR images;

a patient table movable fore and aft in the MRI system about the magnet bore; and

a computer programmed to:

receive input defining a desired FOV larger than an optimal imaging volume of the MRI system;

define a fixed slab with respect to the magnet to acquire MR data;

acquire full MR data with frequency encoding in a direction of table motion, defined as z-direction, for a selected subset of the MR data acquired in at least one transverse dimension in the fixed slab;

continuously move the patient table while maintaining position of the fixed slab;

determine patient table position; and

repeat the acquire and determine acts while the patient table is moving until an MR data set is acquired across the desired FOV to reconstruct an image of the FOV.

17. The MRI apparatus of claim 16 wherein the computer is further programmed to transmit magnetic gradient waveforms to encode a k-space trajectory that is uniform in k_z.

18. The MRI apparatus of claim 16 wherein the computer is further programmed to:

transform MR data with respect to z;

align the z-transformed MR data to match anatomy across slab boundaries; and

transform the z-transformed MR data with respect to at least one remaining dimension to reconstruct an MR image.

19. The MRI apparatus of claim 16 wherein the computer is further programmed to:

apply an RF pulse to excite a volume of interest;

apply a k-space trajectory to encode the volume of interest; and

filter the acquired MR data to restrict the MR data to the defined fixed slab.

20. The MRI apparatus of claim 16 wherein the computer is further programmed to continuously move the patient table to acquire the MR data set across the desired FOV.

21. The MRI apparatus of claim 16 wherein the computer is further programmed to:

acquire all k_z data for a selected subset of transverse k-space data;

define a set of magnetic field gradient waveforms to incrementally encode and acquire data in a given slab; and

apply the set of magnetic field gradient waveforms in a cyclic order.

22. A computer program to control a medical image scanner and create images across scanning boundaries without boundary artifacts, the computer program having a set of instructions to control a computer to:

select an FOV spanning an area greater than a predefined optimal imaging area of the medical image scanner;

apply an RF pulse to excite a region in at least a first direction in the selected FOV;

apply magnetic field gradients to encode the region in the first direction;

acquire k-space data in the first direction for a subset of at least one additional direction;

continuously reposition the predefined optimal imaging area with respect to an imaging object without interruption of motion;

track continuous movement of the predefined optimal imaging area with respect to an imaging object; and

repeat the image data acquisition during continuous movement of the predefined optimal imaging area with respect to an imaging object until complete image data are acquired across the entire FOV to reconstruct an image of the FOV.

23. The computer program of claim 22 wherein the k-space data includes either one of 2D or 3D k-space data and having further instructions to acquire the k-space data using frequency encoding in a direction of table movement.

24. The computer program of claim 23 wherein complete k-space data is acquired in z for a subset of at least one additional dimension.

25. The computer program of claim 22 having further instructions to:

continuously move a patient table for a number of acquisitions until a set of k-space data are acquired for image reconstruction of a given slab.

26. The computer program of claim 22 having further instructions to:

Fourier transform MR data in z;

sort and align the z-transformed MR data to match anatomic locations in z to fill a matrix.

27. The computer program of claim 22 having further instructions to maintain a position of a slab thickness fixed, relative to a magnet of the medical image scanner, during the imaging of the desired FOV and while repositioning the optimal imaging area.

28. The computer program of claim 22 wherein the first direction is a z-direction and the MR data acquired in the z-direction is represented in a number of retained pixels, and where MR data is acquired every sequence repetition and during table movement, and wherein the magnetic field gradients encode a trajectory that is uniform in k_z.

29. The computer program of claim 22 having further instructions to:

acquire all k_z data for a selected subset of transverse k-space;

define a set of magnetic field gradient waveforms to incrementally acquire data in each slab; and

apply the set of magnetic field gradient waveforms over each slab.

30. The computer program of claim 22 having further instructions to:

select a larger slab thickness than that used for imaging;

repetitiously acquire MR data for the larger slab thickness in a direction of table movement;

determine a set of overlapping MR data; and

estimate at least one of table velocity and table position from the set of overlapping MR data.